Remarks

The Examiner has rejected claim 1 under 35 USC 112 as indefinite due to the use of the terms "front" and "back". The applicants find this objection highly unusual and respectfully traverse it. The Federal Circuit has emphasized that patent specifications should be drafted in the language normally understood by persons of ordinary skill in the art in question. Most arts have their own jargon, and PECVD is no exception. In the PECVD art, it is usual to refer to the front and back sides of the wafer, even though the wafers are normally oriented in the horizontal position during deposition. These terms are well understood by persons skilled in the art. The front side (or face) refers to the side facing the reaction chamber. These wafers are not generally oriented in the vertical direction as suggested by the Examiner. A search on Google for backside of wafers revealed multiple hits. A similar search through the US database also revealed numerous hits on the backside and wafer. US patent no. 7,041,547 is one of many using this standard terminology in the art. Websters dictionary defines front as meaning foremost, which in turn means first in rank etc. The front side of the wafer is the main side carrying most of the active components.

Moreover, the Examiner's interpretation of the language is not believed to be correct even in everyday usage. One might refer to the front and back side of a wrist watch, for example. No-one would suggest that the wrist watch need to be oriented in the vertical direction for that language to be meaningful. One might also refer to the front and backside of a floor covering. The backside would be the side intended to contact the floor. No-one would suggest that the front side need be oriented vertically. Similar, one might refer to the front and back sides of an adhesive tape, the back side clearly being the sticky side. Not only is the language used in the claims consistent with the language typically used in the art, it is consistent with the language used in the specification. The applicants respectfully disagree that one skilled in the art would be confused in any way by the correct use of this language in its normal context.

The applicants believe they have corrected any other deficiencies, but given the Examiner's assertion that the words front and back imply a vertical orientation, they cannot guarantee that they have located any other passage the Examiner might find indefinite.

However, in case one skilled in the art would have any difficulty understanding the claim, claim 1 has been amended to refer to a top face and a bottom face. The applicants have also made it clear that the second nitride layer is underneath and contiguous with the second buffer layer exactly as shown in Figure 18g. The Examiner's analogy regarding a sliver of wood under one's skin seems almost metaphysical. Surely, the question is as a practical one. What would one of ordinary skill in this particular art understand in the context of the specification? It is difficult to think of language that is any clearer than that employed to describe the structure shown in Figure 18g. Of course, one can always adopt an unintended interpretation of almost any phraseology. That is the nature of language. But the claim has to be read with a mind willing to understand.

The Examiner has rejected claim 1 under 35 USC 103 over three references and optionally in view of a fourth. None of the references teaches how to obtain high quality waveguides with layers having different refractive indices, which is the basic object of the invention. The Examiner cites the factual enquiries set forth in Graham v. John Deere, and clearly the answer to the first enquiry is that none of the cited references specifically addresses the stress-induced mechanical problems associated with waveguides having layers of different refractive index.

Claim 1 sets forth a detailed sequence of steps, which as demonstrated in the specification result in the production of high quality waveguides which have the required delta n without the stress problems associated with the prior art. It is the combination and sequence of these steps as a whole that results in the novel waveguides. As with every combination invention, it is possible to break it down into its component parts, but that does not make the combination as a whole obvious if it results in a new and useful result.

The Examiner has attempted to reconstruct the invention without regard for the basic objective of the invention by picking and choosing features from the prior art. However, such hindsight reconstruction involves many assumptions that are not derived from the prior art. For example, step *b* requires the first structure to be subjected to a specific sequence of steps to reduce optical absorption and compressive stress prior to deposition of the core layer.

The Examiner's primary reference is Tregoat, which he admits does not disclose the layers on the back face. The Examiner says that it would be obvious to apply a silicon nitride layer to

insulate it from the environment as taught by Liu, but Liu is concerned a capping layer on integrated circuits involving electrical circuits. There is no reason, following the teachings of Liu, why a silicon nitride layer should be deposited on a optical device, which does not involve electrical circuits. Therefore, in the applicant's respectful submission the combination of Tregate and Liu is not proper.

Dealing with step *b*, it is noted that Ohja is concerned purely with the densification of the layers, not stress reduction. Ohja states that in the prior art, long anneal times were employed to the entire structure, which resulted in degradation of the cladding layer. There is no suggestion in the Ohja that the prior art to this patent involved annealing partial structures. In addressing this problem, Ohja teaches anneal times of 30 to 300 seconds. The Examiner is unfairly mixing the teachings of the prior art with the teachings of Ohja, which are that you must use short anneal times. The Examiner states that "It would have been obvious to perform routine experimentation to determine the optimal temperature of the annealing step – depending upon the structure actually made". However, the so-called optimal temperature must be performed in accordance with the teachings of the prior art, not the patent application. The basis of this optimization has to be based on the prior art. Ohja clearly states (see, for example, col. 2, line 39) that the period is chosen " for achieving satisfactory densification of the layers." Thus, if the Examiner combines Ohja with Tregoat, the basis for optimizing the anneal times has to be based on the reason for which the anneal is performed in Ohja, which is different from reason it is performed in the present invention, and anneal times that are optimized for densification, as taught by Ohja, are considerably shorter than the 30 minutes minimum required for the stress reduction in accordance with the invention.

Thus, Ohja discloses two possibilities, it is not permissible to arbitrarily mix the two:

1. Employ the process Ohja describes as prior art, which applies long anneals to a structure including the cladding layer.
2. Employ the process patented by Ohja, which involves annealing the partial structure, but using anneal times in the order of 30 – 300 seconds, the teaching being that the anneal times should be merely

> sufficient to achieve densification. One following the teachings of Ohja would not therefore employ, as a result of the routine experimentation, anneal times longer than 30 minutes.

The same reasoning applies to step *d*. Following the teaching of Ohja, the optimum anneal time would be chosen to achieve densification and in accordance with the teachings of Ohja, this would not be the 30 minutes or more as claimed. In accordance with the invention, the anneal in step b is performed to reduce optical absorption and tensile stress, so an attempt to optimize the anneal times in accordance with the teachings of Ohja, which is to achieve densification, would clearly not result in an anneal time of at least 30 minutes.

With regard to the alleged inherency in the various *b* and *d* limitations, it is respectively submitted that they cannot be inherent because Ohja does not apply heat for the same reason as the applicant and consequently the temperatures chosen will be different, as will the effects obtained. Whereas the applicant is reducing stress and optical absorption, Ohja is merely trying to achieve densification of the deposited layers. Ohja does not recognize the importance of anneal treatments in the context of stress reduction and optimization of optical properties. Ohja is premised on the assumption that the deposited layers require consolidation to form a vitreous composition (see col. 1, line 26), so any choice of parameters would be based on this teaching, and such teaching would not lead to inherent stress reduction as set forth in claim 1.

Similar considerations apply to the ramp rates. These are optimized as shown in Figures 19 and 20 to optimize stress and absorption parameters. Since Ohja teaches annealing for an entirely different reason, namely vitrification and densification, there is no reason why one skilled in the art following the teachings of the art would arrive at the ramp profiles claimed and which result in the improved waveguides.

With regard to claims 13 and 18, which are limited to the preferred maximum temperature of 900°C, it is respectfully pointed out that these claims cannot be obvious over the teachings of Ohja because they are inconsistent with his requirement that the sustained treatment be above or close to the reflow temperature. According to Ohja a initial brief treatment (see col. 4, line 36) is performed at from 840 – 930C below the flow temperature (see col. 2, line 42) for 30 to 300

seconds to drive off bonded materials, and this is followed by a temperature treatment of 30 – 300 seconds at temperature above or close to the reflow temperature (1150 – 1250C) (see col. 2. line 38) for achieving satisfactory densification. It would therefore be entirely inconsistent with the teachings of Ohja to hold the wafer at a temperature of only 900°C for over 30 minutes, and optimization in accordance with the teachings of Ohja would result in a period sufficient to drive off volatile materials or densificiation, but which would clearly not result in the optimized waveguide products of the invention.

Moreover, it is respectfully submitted that Ohja does not teach the separate anneal steps that are necessary to produce the optimized waveguides of the invention. As claimed as the invention involves heating the structure including the cladding layer. In a vague reference in col.2, lines 17-19, Ohja states that "in a further embodiment, the invention is concerned with annealing the buffer layer, or annealing both this and the core layer, before the cladding layer is deposited. There is no description of this process, and there is no indication proposes an anneal step after each deposition as claimed. It appears in this paragraph that he is suggesting annealing the buffer layer, or a combination of the buffer layer and the core layer, but not a sequence involving annealing the buffer layers, the core layers, and then depositing the cladding layer.

The applicants have claimed a specific sequence of steps that permit the production of waveguides with improved properties. Of course, it is possible to find in the prior art the individual elements of the combination of steps claimed, and it is possible to assert with the benefit of hindsight, that their combination would be obvious, but the fact is that the prior art does not teach the combination, and more importantly does not teach how to make high quality waveguides as demonstrated in considerable detail with extensive analysis in the specification.

In summary, Ohja teaches an anneal process for an entirely different reason, and even if the Ohja anneal process were applied to Tregate, a person skilled in the art following the teachings of Ohja would not arrive at the same conditions as set forth in claim 1 because he would be setting the parameters based on the teachings of Ohja. The invention cannot therefore be obvious based on the traditional criteria because the prior art does not suggest, either alone or in combination, the specific sequence of steps recited.

Reconsideration and allowance are therefore respectfully requested.

Respectfully submitted,

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